CLAIMS

I claim:

1. An apparatus for transferring gas-phase ions or particles from an ion source region into an ion collection region, the improvement wherein said apparatus comprising:

   a. a dispersive source of ions;

   b. a stratified tube consisting of a plurality of elements, said elements comprise alternating layers of metal electrodes and dielectric insulators, through which at least some of said ions from said ion source pass unobstructed;

   c. a tube exit region, one wall of which is formed by an exit element of said stratified tube, said tube exit region upstream of said ion collection region, and means for maintaining the ambient pressure in said tube exit region substantially below that in said ion source;

   d. means for maintaining a potential difference between said ion source and said stratified tube which is equal to that required to pass substantially all said ions into inlet of said stratified tube;

   e. means for maintaining a potential between said individual elements of said stratified tube which is at least as great as that required to maintain the direction of said ions at or near coaxial within stratified tube; and

   f. means for maintaining and controlling the temperature of said stratified tube

2. Apparatus as in claim **1** wherein said ion source region is at or near atmospheric pressure, gas-phase ions are formed by means of atmospheric or near atmospheric pressure ionization, electrospray, atmospheric pressure chemical ionization, laser desorption, photioization, discharge ionization sources, natural ionization; or a combination thereof.

3. Apparatus as in claim **1** further including an analytical apparatus in said ion collection region, said analytical apparatus comprises a mass spectrometer or ion mobility spectrometer or combination thereof, a wall with an aperture separates said tube exit region from said ion collection region, said ions in said tube exit region pass through said aperture into said ion collection region where they are analyzed by mass spectrometric means.

4. Apparatus as in claim **1** wherein said ion source is at a pressure greater than atmospheric pressure.

5. Apparatus as in claim **4** further including said tube exit region at or near atmospheric pressure.

6. Apparatus as in claim **1** further including a high-transmission element, sandwiched between said ion source and said stratified tube, said high-transmission element being comprised of a thin metal electrode populated with a plurality of openings, said plurality of openings provide conduits for said ions from said ion source to pass through on their way to said stratified tube, electrostatic potential of said high-transmission element is such that the electrostatic fields on underside of said high-transmission surface is greater than electrostatic fields in said ion source and less than electrostatic fields from said stratified tube, whereby substantially all said gas-phase ions from said ion source are attracted to and pass through said plurality of openings exiting said conduits and are transferred into inlet opening of said stratified tube.

7. Apparatus as in claim **6** further including a pure gas supplied in such a way between said inlet of said stratified tube and said high-transmission element, whereby substantially all said gas flows through said plurality of openings in said high-transmission element and into said ion source region, flowing counter to the trajectories of said gas-phase ions.

8. Apparatus as in claim **6** wherein said high-transmission element can be comprises of a laminated structure populated with a plurality of openings providing conduits from said ion source region to a region upstream of said stratified tube for the purpose of collecting and transferring substantially all said ions from said ion source to said inlet of said stratified tube, said laminated surface having an insulating base and metal laminate on topside and underside of said insulating base, electrostatic potential difference between said metal laminates on top-side and underside is such that the electrostatic field on underside of said laminated high-transmission surface is greater than electrostatic field on topside of said surface and greater still than electrostatic field from said ion source, whereby substantially all said gas-phase ions from said ion source are focused into said plurality of openings, passing through said laminated element and being directed into said inlet of stratified tube.

9. Apparatus as in claim **1** wherein the ratio of diameter of the lumen of said tube to the thickness of said individual metal electrodes is greater than 1-to-1.

10. Apparatus as in claim **1** wherein the ratio of thickness of said dielectric insulator to the thickness of said individual metal electrodes is less than 20-to-1, in the region where dispersive electric fields are present.

11. Apparatus as in claim **1** further including a pure gas supplied in such a way between said inlet of said stratified tube and ion source region, whereby substantially all said gas flows into said ion source region, flowing counter to the trajectories of said gas-phase ions.

12. Apparatus in claim **1** further including at least one of said metal electrodes has RF potential.

13. An apparatus for transferring gas-phase ions or particles from an ion source region into an ion collection region for mass spectrometric analysis, the improvement wherein said apparatus comprising:

a. a dispersive source of ions;

b. a stratified tube consisting of a plurality of elements, said elements comprise alternating layers of metal electrodes and insulating materials, through which at least some of said ions from said ion source pass unobstructed;

c. a high-transmission surface sandwiched between said ion source and said stratified tube, said surface populated with a plurality of openings through which substantially all said ions pass unobstructed, said laminated surface having an insulating base and metal laminate on topside and underside of said insulating base;

d. an tube exit region, one wall of which is formed by an exit element of said stratified tube, another wall with an aperture which separates said tube exit region from said ion collection region, means for maintaining the ambient pressure in said tube exit region substantially below that in said ion source;

e. means for maintaining a potential difference between said metal laminates on topside and underside of said high-transmission surface which is equal to that required to attract substantially all said ions toward said metal laminate on topside of said high-transmission element to pass said ions unobstructed through said plurality of openings in said high-transmission element;

f. means for maintaining a potential difference between said metal laminate on under-side of said high-transmission element and said stratified tube which is equal to that required to pass substantially all said ions that have exited openings in said high-transmission element into inlet of said stratified tube; and

g. means for maintaining a potential between said individual elements of said stratified tube which is at least as great as that required to maintain the direction of said ions at or near coaxial within stratified tube.

wherein said ions are transferred through said aperture in said wall separating said tube exit region and said ion collection region, and said ions are analyzed by means of mass spectrometric analysis in said ion collection region.

14. Apparatus as in claim **13** wherein said ion source region is at or near atmospheric pressure, said gas-phase ions are formed by means of atmospheric or near atmospheric pressure ionization, electrospray, atmospheric pressure chemical ionization, laser desorption, photioization, discharge ionization sources, natural ionization; or a combination thereof.

15. Apparatus as in claim **13** further including electrostatic and time varying lens in said ion collection region for the collection, transfer, and mass spectrometric analysis of said ions.

16. Apparatus as in claim **13** further including a pure gas supplied in such a way between said inlet of said stratified tube and said high-transmission surface, whereby substantially all said gas flows through said openings in said laminated high-transmission surface and into said ion source region flowing counter to the trajectories of said gas-phase ions.

17. A method for collection and transfer of ions or charged particles from an ion source region, transferring approximately all said ions or charged particles into a **lower pressure region**, comprising:

a. providing a perforated high-transmission surface populated with a plurality of openings, said high-transmission surface made up of an insulating base and metal laminates contiguous with topside and underside of said base;

b. applying an electrostatic potential gradient across said laminated surface, such that electrostatic field lines between said ion source and said perforated high-transmission surface are concentrated into said plurality of openings wherein substantially all said ions are directed through said

openings unobstructed into a region downstream of said high-transmission surface;

c. providing electrostatic attraction to said ions in said region downstream of said perforated high-transmission surface with a electrostatic field generated by a stratified tube, said stratified tube made up of alternating electrodes and insulating bases, said electrostatic field between said high-transmission surface and said stratified tube are concentrated into entry or opening of said stratified tube as a reduced cross-section area;

d. providing a pure gas supplied in such a way that said gas flows between said opening of said stratified tube and said high-transmission surface, whereby substantially all said gas flows through said plurality of openings and into said ion source region, flowing counter to the trajectories of said ions;

e. applying an electrostatic potential gradient along said stratified tube such that electrostatic field lines direct said ions at or near coaxial within the lumen of said stratified tube;

f. directing substantially all said ions as they exit said stratified tube into said lower pressure region into a collection region;

whereby said stratified tube can be used to transfer substantially all said **ions formed at or near atmospheric pressure** into said ion collection region for mass spectrometric analysis.

18. A method for collection and transfer of ions or charged particles from an ion source region, transferring approximately all said ions or charged particles into a **lower pressure region**, the method comprising:

a. providing electrostatic attraction to said ions in said ion source region with a electrostatic field generated by a stratified tube, said stratified tube made up of alternating electrodes and insulating bases, said electrostatic field

between said ion source region and said stratified tube are concentrated into entry or opening of said stratified tube as a reduced cross-section area;

b. applying an electrostatic potential gradient along said stratified tube such that electrostatic field lines direct said ions at or near coaxial within the lumen of said stratified tube;

c. directing substantially all said ions as they exit said stratified tube into said lower pressure region;

whereby said stratified tube can be used to transfer substantially all said ions into said lower pressure for collection, deposition or a combination thereof.

19. The Method of claim **18** wherein said ion source is at a higher pressure than atmospheric pressure, resulting in the pressure in said lower pressure region at or near atmospheric pressure.

20. Apparatus as in claim **18** wherein one or more of said electrodes in stratified tube has a RF potential applied to it resulting in enhanced focusing of said ions into the center of the lumen of said tube.

21. Apparatus as in claim **18** wherein one or more of said electrodes in stratified tube has a RF potential applied to it resulting in differential transmission of said ions based on ion mobility.